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MEETING WITH THE ASTRONAUTS

(Project Mercury—Man-in-Space Program)

THE UNIVERSITY OF MICHIGAN
SEP 17 1959
MAIN READING ROOM

HEARING

BEFORE THE

COMMITTEE ON SCIENCE AND ASTRONAUTICS U. S. HOUSE OF REPRESENTATIVES

EIGHTY-SIXTH CONGRESS

FIRST SESSION

EXECUTIVE SESSION

MAY 28, 1959

[No. 37]

Printed for the use of the Committee on Science and Astronautics

UNITED STATES
GOVERNMENT PRINTING OFFICE
44151 WASHINGTON : 1959

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THURSDAY, MAY 28, 1959

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C.

EXECUTIVE SESSION

The committee met, pursuant to notice, in room B–214, New House Office Building, at 10:28 a.m., Hon. Overton Brooks (chairman) presiding.

The CHAIRMAN. We are in executive session.

We are certainly pleased to have these distinguished guests of the committee this morning. We want to talk to them freely in executive session here because none of this will be reported in the press unless it is approved for release by the NASA.

Mr. MILLER. Special Subcommittee No. 1 will leave here at 8:30. We invite you to go with us to the Bureau of Standards. We are leaving Friday morning. We will have lunch there, then look over their new site in the afternoon, and return around 4 o'clock. Any of you who want to go are welcome.

The CHAIRMAN. It is a very important responsibility, and I hope all of the members of the committee who can go will take advantage of Mr. Miller's invitation.

JAMES GLEASON, ASSISTANT ADMINISTRATOR FOR CONGRESSIONAL RELATIONS, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. GLEASON. Mr. Chairman, we are very pleased to have this opportunity to bring up the astronauts to visit with the members of the committee. You have had on several occasions a presentation on the technical phases of Project Mercury. We thought there might be some desire on the part of the members of the committee to question the astronauts personally, to get their views of their program, their training, and we are very happy to be here with you today. This is all that I have to say.

The CHAIRMAN. We want to ask them, as you say, a few questions. You haven't organized your astronauts into president, vice president, or chairman or vice chairman or secretary or anything of that sort, have you?

Who is the spokesman?

Mr. GLEASON. Not officially. They can all speak for themselves. You have, I believe, in front of you a picture of the group with the names of each of them.

The CHAIRMAN. I would like to ask Mr. Carpenter to open the proceedings. I have a question or two. I would like to ask him how his training is working out and what is his reaction to the astronauts' training schedule.

ASTRONAUT MALCOM S. CARPENTER

Mr. CARPENTER. I feel that our time is being very well used. I believe that the training schedule as it is being put together by the people in charge of the project is all inclusive.

The CHAIRMAN. It is in line with what you think is appropriate for a training schedule of this character?

Mr. CARPENTER. I can't think of anything that has been neglected.

The CHAIRMAN. Of course, you know you are blazing a new trail and there is not much precedence to go by. But certainly your schedule contemplates aeronautics, doesn't it, as well as astronautics?

Mr. CARPENTER. Yes, sir.

The CHAIRMAN. Are they working you hard? Are they feeding you well?

Mr. CARPENTER. Yes, and yes—although being fed is my wife's job.

The CHAIRMAN. Now, are there any questions?

Mr. CHENOWETH. Mr. Chairman.

The CHAIRMAN. Mr. Chenoweth.

Mr. CHENOWETH. I think it is fitting you should have called upon Mr. Carpenter first. We take pardonable pride in Colorado in the fact we have two boys here in this group, Mr. Carpenter and Mr. Cooper. Mr. Carpenter is from Boulder, Colo., where he was born and raised and attended school. Mr. Cooper considers Carbondale his home; so we take great pride in that fact, Mr. Chairman. These are two fine young men.

The CHAIRMAN. Mr. Fulton suggests you left out Pennsylvania and I suggest they left out Louisiana.

Mr. OSMERS. Mr. Chairman, they did not leave out New Jersey. I am very proud that Walter Schirra is one of the astronauts in training at the present time.

Mr. FULTON. I was going to compliment the Congressmen and say that we on the Republican side are very proud of two astronauts—and Mr. Chenoweth of Colorado, who is also a very high-flying, good Congressman.

The CHAIRMAN. I want to say this to the astronauts. The committee wants to cooperate with you and with the NASA. We want to make this program most successful in every respect. We want to give our full cooperation. I am sure I speak for every member of the committee when I say we all want to cooperate with you to the very fullest so that the program will not only be pleasant, but will be very successful to everyone.

Mr. ANFUSO. Mr. Chairman, I would like to say this: That while they left out the most important State in the Union, the largest State in the Union as far as population is concerned, New York is considered the capital of the world. So you men are really pioneers in this

world project, this universal project. I want to say you are all welcome to New York at any time as my guests.

The CHAIRMAN. You represent them all now. Mr. Fulton.

Mr. FULTON. I do think we should ask you men some questions seriously.

Mr. ROUSH. Would you yield so I could get Indiana in here?

Mr. FULTON. I yield to you.

Mr. ROUSH. Mr. Chairman, Indiana is the crossroad of America. Mr. Chairman, the motto of Indiana happens to be "The Crossroads of America." We truly are. We are very proud to have Captain Grissom among this group. He not only was raised in Indiana, but he was educated in one of the finest universities of this country, Purdue University. We are very proud of him and glad he is among the seven men. Thank you, Mr. Chairman.

The CHAIRMAN. We are certainly happy to have him. Mr. Fulton is recognized again.

Mr. FULTON. I think we should have some serious questions. As you men know, you are an outstanding group in our country and probably in our country's history. While we are having some good humor about it, nevertheless we respect you for your daring and for your seriousness of purpose.

Secondly, we on this committee want Project Mercury to be a success. That means you will have our full cooperation, as the chairman has said.

Thirdly, the difference between us and the people we are competing with is we want you to be safe and we want this flight to be a successful one in that sense, to you personally and to your families. I want to ask each of you whether you feel, first, that the training is adequate, and secondly, that enough precautions are being taken for your personal safety and for the good of the experiment?

While we want you to be the first ones in space, nevertheless we want each of you taken care of. So, I would like to hear from each of you, briefly, how you feel about the program. Are enough safety measures being taken? Is it proceeding at an orderly research and development pace? Are the considerations and factors that should be taken into account being taken as far as you are concerned?

I say this is the first time we have had your point of view. We have had the scientists' views many times. I would like each one to give his own feeling about it. This record, while it is not public, may sometime be made public so that you should consider that this is your philosophy or your approach to space and also your feeling about how this experiment is being conducted.

If something should ever go wrong, it will be quickly referred to, let me tell you. So it is a serious statement that you must make. Thank you.

Mr. GLEASON. May I suggest, Mr. Fulton, that in line with your suggestion, we go right down the group, starting from the right with Mr. Shepard. Did you understand the questions?

ASTRONAUT ALAN B. SHEPARD, JR.

Mr. SHEPARD. Yes.

In answer to your question, sir, I have been very favorably impressed with the NASA since I have been associated with it. This

favorable impression has accrued from some of the aspects of which you just spoke, the steps and the pains they have taken to provide essentially parallel systems in many areas in this missile-capsule combination we are interested in.

Mr. FULTON. I would rather have it not in the context of complimenting an agency, but are you satisfied with the precautions for safety, with the research and development plans, with the alternative methods that might be used? Is the best one being used?

How do you approach this space program? Will you give it to us sort of in that order?

Mr. SHEPARD. Yes, sir, I am satisfied—in one word. Did you want more?

Mr. FULTON. On the safety factors particularly. I would rather have you spell it out.

Mr. SHEPARD. I think we could use an analogy here that all of us actually have been involved in test flying before, as you may know. We have accepted certain calculated risks—risks calculated by ourselves and by technical advisers. I don't feel that the risk involved in this program is any greater than risks that we have undertaken previously in our work.

Mr. FULTON. There are no unnecessary risks being taken?

Mr. SHEPARD. It is pretty hard to give an unqualified answer to that question. I think there is a risk walking across the street, really.

Mr. FULTON. Every risk is being guarded against, and no unnecessary risks are being included in the program?

Mr. SHEPARD. Everything is being considered, yes.

Mr. FULTON. May we hear the next man?

Mr. GLEASON. That is Mr. Glenn.

ASTRONAUT JOHN H. GLENN, JR.

Mr. GLENN. I think carrying this along the same line Al was talking about, in each one of the areas that goes into the project—in other words, the escape mechanism from the missile, for instance, or the wiring for the system—each one of these things is proceeding along its own path here through a very definite buildup and test program. I don't think, as fresh cotton, more or less, as we are to this program here, I haven't seen any one of these systems, the buildup to these so far, that I would change a bit.

I think it is a very orderly buildup to the final meeting of all of these systems into the whole capsule. I have been very much impressed so far with the fact that they are taking great pains to make this an orderly buildup and are not skipping any big areas that we would have some apprehension about.

Mr. FULTON. So you are satisfied that every precaution for safety is being taken on behalf of everybody here?

Mr. GLENN. Yes.

Mr. FULTON. The next man.

Mr. GLEASON. Mr. Grissom.

ASTRONAUT VIRGIL I. GRISSOM

Mr. GRISSOM. I feel that the risks have been minimized. We have duplicate systems on everything and I am quite satisfied with the

way NASA is going about taking care of our safety, and is taking care of us.

Mr. FULTON. You are satisfied that the research and development is at a high enough level for this particular program?

Mr. GRISSOM. Yes.

Mr. GLEASON. Mr. Carpenter.

ASTRONAUT MALCOLM S. CARPENTER

Mr. CARPENTER. I feel that everything has been considered as far as humanly possible in a project that has never been undertaken before. We also have been guaranteed that if we, as pilots, find anything that we consider unsafe, or improperly designed, this will be corrected. This has been demonstrated to us already.

Mr. FULTON. Do you feel that all unnecessary risks have been guarded against and adequate precautions taken?

Mr. CARPENTER. I do, sir.

Mr. FULTON. Thank you. Next.

Mr. GLEASON. Mr. Cooper.

ASTRONAUT LEROY G. COOPER, JR.

Mr. COOPER. I agree, sir. I am very well satisfied that all eventualities have been thought about and discussed and studied from all angles. I am satisfied that the program is going very satisfactorily in this aspect.

Mr. GLEASON. Mr. Schirra.

ASTRONAUT WALTER M. SCHIRRA, JR.

Mr. SCHIRRA. In answer to your question, Mr. Fulton, I believe you must remember we are volunteers. If we do not feel satisfied with the research and development program, the safety aspects, it is our option to say "No." We have had full cooperation, so we are satisfied.

Mr. GLEASON. I think this is a point we might emphasize in the record. If at any time any of the volunteers want to withdraw from the program, it is their right to do so.

The CHAIRMAN. Will the gentleman yield?

I would like to ask each one so the record will show that they are volunteers.

Mr. GLEASON. They are all volunteers, Mr. Chairman.

The CHAIRMAN. Is there anybody here who is not a volunteer?

(Chorus of "No, sir.")

Mr. GLEASON. Mr. Slayton.

ASTRONAUT DONALD K. SLAYTON

Mr. SLAYTON. Well, sir, I can add nothing to what the other gentlemen have said. I think that every possible precaution is being taken to watch for our safety. I personally feel that there is no more risk involved than in the first flight of any normal production-type airplane which we are accustomed to flying.

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Mr. FULTON. As a national policy, you feel this is a necessary step in research and development that we have man in space so that you are willing to be part of the research team and risk your lives for it?

Mr. SCHIRRA. Yes, sir.

Mr. FULTON. You all agree on that?

It is just not a casual thing; this is necessary for our national progress and for our national defense. Do each of you feel that way? I would like to know your philosophy of it.

Mr. GLEASON. Mr. Fulton, I am sure you appreciate that these gentlemen don't set the policy on the program.

Mr. FULTON. I do, but I want to make sure that each of them takes it not as a stunt, but as something necessary for our defense and necessary to maintain the lead of the United States on research and development.

Is that the way you look at it?

(Chorus of "Yes, sir.")

The CHAIRMAN. Mr. Hechler, the Chair will recognize you.

Mr. HECHLER. I have just a brief question. You fine gentlemen have indicated that you had an opportunity to make suggestions about this program. I wondered if you had made any specific suggestions and, if so, what were they and what was done about it?

Mr. SCHIRRA. I could carry the ball, if you like. We recently were at McDonnell, the company that is producing the capsule. We participated in an inspection of the capsule mockup, including the pilot's station, where we will be. This is our station in the program. We have quite a few changes that we requested. All but two, I understand, were immediately taken care of and the other two are under investigation. So this cooperation satisfied us completely.

Mr. HECHLER. Since we are in executive session I wonder if you could be more specific. I am interested in the type of suggestion that you made on the capsule.

Mr. SCHIRRA. I could name one. Actually test pilots as such make a lot of suggestions like mad. I would have to recount possibly 50 or 60 items which we might disagree or agree upon. One thing in particular we did not like the restraint system as it was in the mockup, the physical restraint system. We requested a change on that. That has been incorporated.

Mr. HECHLER. Do any of the other gentlemen care to comment on this?

Any suggestions that have been made?

GEORGE M. LOW, CHIEF, MANNED SPACE FLIGHT, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. LOW. Mr. Chairman, I would like to make one point on this subject.

Mr. GLEASON. This is Mr. Low, who is chief of our manned space flight programs.

The CHAIRMAN. All right, Mr. Low.

Mr. LOW. This suggestion of changes by this group of astronauts was not accidental. We had planned in our program on taking the astronauts to McDonnell to look over the capsule and to tell us

specifically how the pilot display and how the cockpit layout should be handled because we feel they are experts in this area. They are therefore not really making changes; they are responsible for the design in this area.

Mr. HECHLER. Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Riehlman.

Mr. RIEHLMAN. In following up Mr. Fulton's question, these gentlemen apparently are not interested in this being a stunt affair. You have all been test pilots, haven't you, in the past?

(Chorus of "Yes, sir.")

Mr. RIEHLMAN. You have taken this business pretty seriously. You know something about what you are going to be confronted with in this new test. As the chairman said, you are blazing a trail here and every one of us is vitally interested in what you do.

Of course, we are interested in your security and your safety as much as possible. With the experience you have had up to date, and your knowledge about flying, what is your present attitude toward the success of this type of a flight?

Do any of you care to comment on it?

Mr. CARPENTER. I will say very good.

Mr. RIEHLMAN. You feel very satisfied that this flight, when it is eventually ready for test, will be successful?

(Chorus of "Yes, sir.")

Mr. CARPENTER. This is borne out by information that comes to us daily. All of the related tests, the results of these tests are favorable.

Mr. RIEHLMAN. You certainly, each one of you, have had a tremendous amount of experience and background in test flights in all of our types of planes. Am I correct in that?

(Chorus of "Yes, sir.")

Mr. RIEHLMAN. The latest types of planes?

Mr. SHEPARD. I think it is pertinent to point out here, as has been indicated by the NASA—and I am sure this is something we all agree with—that the probability of success of this mission is one of the governing criteria. In other words, a mission won't go until we reach a certain level of probability of success.

Mr. RIEHLMAN. You certainly are not going to volunteer to go until you feel definitely sure in your own minds that everything has been done so that this flight will be a success?

(Chorus of "Yes, sir.")

Mr. RIEHLMAN. Each and every one of you is in a position where you are going to have an opportunity to express your own opinions as it progresses, if I understand the program correctly.

(Chorus of "That's right.")

Mr. RIEHLMAN. So you can make suggestions and the NASA will accept your advice and assistance in planning this program. So, if there is any possibility of your thinking that there are certain gadgets that have to be changed or certain—I know very little about the equipment that goes with it, but whatever is necessary will be taken care of.

The CHAIRMAN. I want to ask this question and then I am going to recognize Mr. Wolf. All of you gentlemen have been in this type of work—that is, handling experimental planes in the past, haven't you? You know what this is. You know that in handling any new ex-

perimental flying machine there is a certain type of risk. You understand that; isn't that right?

(Chorus of "Certainly.")

The CHAIRMAN. You fully understand. As far as testing an experimental vehicle in flight is concerned, you all have done that before, and you know what it is. Mr. Wolf.

Mr. WOLF. Thank you, Mr. Chairman. It is my understanding that only one of you gentlemen will go into orbit; is that correct?

Mr. LOW. On the first flight.

Mr. WOLF. But before this first orbital flight is attempted, several of you will have an opportunity to go into outer space and return in missile flights; is that correct?

Mr. LOW. May I answer that?

The CHAIRMAN. Surely, Mr. Low.

Mr. LOW. In our current buildup program toward the orbital flight we have a number of smaller missile boosters that will be used. One of these in particular is the Redstone booster. After a number of unmanned flights in this Redstone, and after a number of flights with animals using the Redstone booster, these gentlemen will also fly in the Redstone as part of their training for the final mission, and as part of the qualification for the final mission.

In these Redstone flights, they will go to an altitude of about 100 miles and down range about 100 miles.

Mr. WOLF. I had one other question, Mr. Chairman. The other question was: Do you have some special pay or some special incentives that encourage you in this direction?

(Chorus of "No.")

Mr. GLEASON. Just the regular pay.

Mr. SCHIRRA. I would like to see something like Project Mercury develop. That is my incentive.

Mr. WOLF. I thought this would be something good to bring out. That is the idea. I thought it would be important to have this on the record, that you did not volunteer because you are getting a fancy pay allowance or anything like that.

Mr. ANFUSO. Mr. Wolf, you were asking the very question I wanted to ask. I wonder if we could have an answer from each one. What was their primary motive in volunteering for this assignment?

Mr. GLEASON. Let me say for the group that their pay is the same pay that they would have been drawing in their regular work with the military services. There are no extra remunerations of any kind connected with their new activities.

Mr. BASS. Would you yield for a question, Mr. Wolf?

I didn't quite get the answer to Mr. Wolf's question. Is there only going to be one astronaut that makes the flight in orbit two or three times around the earth——

Mr. LOW. There will be only one astronaut in the capsule at a given time. It is a one-man capsule or a one-man satellite. But there will be a number of flights.

Mr. BASS. In orbit?

Mr. LOW. In orbit. There will not be only one flight. There will be succeeding flights at later times.

Mr. BASS. So that every one of the seven astronauts will, before this project is over, either be in orbit or be in major flight?

Mr. Low. I don't think we can guarantee that every one of them will make the flight because this Project Mercury is just one step in a long program of manned spaced flight that will lead on to more advanced systems. After a number of Mercury flights—it may be 4, it may be 6, or it may be 10—we may be ready with the next following system and some of these men may fly only in advanced space vehicle systems.

The CHAIRMAN. It has been suggested that we have these men here and that we ought to limit recognition on the committee to one time. After that we should release them because we have another witness here.

So I am going to recognize each member one time. Mr. Osmers.

Mr. OSMERS. Mr. Chairman, I think possibly what I want to say is more in the nature of a statement than a question, though I would like to have the views of the astronauts.

The questioning here this morning has all been on the basis, it seems—most of it—that the projected flight is a stunt, a one-time stunt. Who will go on this one flight? Of course, to me Mr. Chairman, there is a tremendous significance about what is being done here that certainly will make the first flight a very significant milestone in history.

But, to me, it is a beginning and not an end in itself.

The question that I want to ask is this: Do the astronauts that are here believe that space travel and outer space will be used and should be used for man's peaceful purposes? That basically is my question. They are all nodding. I will say that so the record will show they are in agreement with the question.

The CHAIRMAN. They are all in agreement with that. Mr. Anfuso.

Mr. ANFUSO. Mr. Chairman, I would like to ask each astronaut what prompted him to volunteer for this assignment and whether each one feels that the Government is doing enough for them, and their families, in connection with this assignment?

Mr. SHEPARD. To answer your first question, as I understand it, why did we volunteer for this program: In my particular case it was a realization that, as Mr. Chenoweth just indicated, this really is the first step in space travel. This is a personal opinion which I agree with. Quite frankly I am delighted at having been given the opportunity to participate in this program.

Of course, as we have indicated before, we have considered the dangers and there is satisfaction in those areas. The answer to your second question, is the welfare of myself and my family being properly considered? Was that the question?

Yes, I believe that it is. I might point out from a financial standpoint, of course, we have had insurance programs before in connection with some of our other flying duties. I would possibly like to have a little more insurance, but in consideration of the premiums, I truthfully can't afford it at this time.

Mr. ANFUSO. What amount of insurance do you have now, Mr. Shepard, in connection with the flight?

Mr. SHEPARD. I have all personal life insurance policies covered with an aviation coverage, which, of course, as you understand, makes for higher premiums.

Mr. ANFUSO. There has been no special form of insurance provided for this particular flight?

Mr. SHEPARD. No, sir; that is correct.

Mr. ANFUSO. You would welcome some kind of insurance award from the Government in connection with this flight?

Mr. SHEPARD. I have no particular desire. I think everyone ought to feel his insurance program is inadequate. I make no specific request for additional insurance at this time.

The CHAIRMAN. Any further questions?

Mr. CHENOWETH. Mr. Chairman.

The CHAIRMAN. Mr. Chenoweth.

Mr. CHENOWETH. I would like to inquire concerning the time element involved here; what the prospects are for the first flight. What is your goal? What are you aiming at? Do you have a target?

Mr. LOW. Our target must necessarily be a flexible one because this capsule has not yet been built, although it is being built at the present time. The research and development program has not been completed. We don't know where along the line we may be delayed by a week or a month or perhaps several months.

* * * * * * *

Mr. CHENOWETH. I think it was the intention of Mr. Anfuso to ask all the boys what motivated them to volunteer and the challenges that are presented. I would be interested to hear their impressions.

Mr. Chairman, they are very interesting and I think very important for us.

The CHAIRMAN. Do you want to ask each one? We have a witness this morning. As I say we don't want to overdo it.

Mr. CHENOWETH. I would like to hear from the boys.

The CHAIRMAN. All right, let's hear from them.

Mr. GLEASON. Mr. Glenn will carry on.

Mr. GLENN. As to my motivation in this, I look at Project Mercury with regard to space as at about the same place as the Wright brothers were 50 years ago or so with regard to aviation. Working in aviation and being in test flying and volunteering for this sort of thing puts us in the vanguard of our chosen profession, more or less. So I look at this as being the same thing as possibly you gentlemen looked at when you were aspiring young lawyers, you looked at Congress and thought you could possibly never even hope to attain such heights. But here you sit, nevertheless.

The CHAIRMAN. If the gentleman will yield, when they run one time they run again. Now Columbus made four trips to the New World. Will you be interested in a second trip?

Mr. GLENN. Perhaps the dangers in your profession are more than they are in this.

Mr. MILLER. I would like to say we are not all lawyers, thank God.

The CHAIRMAN. Who is the next one to answer that?

Mr. LOW. Mr. Grissom.

Mr. GRISSOM. Having been in test work for some time and doing basic research work, this is a natural extension of that work. It is just natural for me to come on into this. I am very pleased to have the opportunity.

Mr. CARPENTER. I feel that this is the greatest opportunity to pioneer that has ever been. I might add at this point that one of the

questions we were asked in the original elimination program was: Would you be interested in this program if you weren't one of the lucky few to fly?

I am sure we all answered "Yes," just to be associated with a program of a pioneering type like this is an honor to all of us.

Mr. COOPER. Flying and aviation is my career. I feel that space flight is a very natural progression from aviation as we have known it. To me it is very great privilege and honor to be included in a program of this type, to be in on the ground floor of something very new at the beginning.

Mr. SCHIRRA. One of the things we have talked of as test pilots is expanding the flight envelope, which means to go higher and faster. You see, in a progression of airplanes coming along that are now flying at steady altitudes of 65,000 and 70,000 feet, this progression of airplanes is also added onto by space. It is merely that we are expanding this flight envelope. We are going considerably higher and considerably faster, and obviously farther. This is what we are interested in, I am sure.

Mr. SLAYTON. I am basically the same as the rest of the people. I have been in test flying for the past 4 years. To me it is just a natural extension of what I have been doing.

As Mr. Schirra says, it is an expansion of the envelope. I believe we are very fortunate to be selected to be in on the first part of it.

Mr. MCDONOUGH. Mr. Chairman.

The CHAIRMAN. Mr. McDonough.

Mr. MCDONOUGH. Any one of you gentlemen can answer this. I suppose you have all had the same experiences up to the present time. How close to simulation of the environment that you will experience in this capsule while in orbit have you approached up to the present time?

Mr. GLENN. This is very difficult to simulate, of course, because we are going out into a field in which we are going down paths which no one has ever trod before, more or less. Especially in this field of weightlessness, which is extremely difficult to simulate. I am sure you have seen pictures of some of the simulation of weightless flying that has been going on at Wright Field where they use a transport plane and do a pushover at zero G and the pilot is weightless.

You can simulate weightlessness that way for a very short period of time. That is probably the most difficult thing to simulate, because we just have no way of doing it.

As far as the rest of the things that we foresee, as far as heating during reentry and problems like that, these can be simulated in pretty good shape.

Mr. MCDONOUGH. I imagine that you have had, in all your minds, an image of yourselves going into this capsule and coming back.

Mr. GLENN. Yes, sir.

Mr. MCDONOUGH. You anticipate certain difficulties. What is the greatest difficulty that arises, in your mind? Perhaps that varies in the opinion of the seven of you. What do you think is the greatest difficulty you will face after you get away, after you are up there—radiation, claustrophobia, being alone, confined, being on your own, the possible failure of the machine, the heat of reentry—just what is it?

Mr. GLENN. This would be real difficult to say. I don't foresee any one of these areas as being particularly difficult; they all have to function properly, of course. It is an integrated machine, all parts of which have to function properly, and most areas of which have back-up systems to make them function properly.

The way the project is outlined so far, I don't foresee one area being particularly more hazardous or of more concern than the other areas. Perhaps some of the other gentlemen have some areas they would like to comment on.

The CHAIRMAN. Any further comments on that?

Mr. MCDONOUGH. Do you feel you are being prepared for this flight with as much precaution as the Wright brothers took when they jumped off in their first plane?

Mr. GLENN. On the contrary, I would say we are being prepared for this flight in much better fashion than they were prepared for theirs. I think they were pretty much cut and dried, and ours is not that way. We have, as I mentioned before, a very logical buildup program in each one of the systems involved in the capsule here that make it, I think, a much more reliable deal, probably, than the Wright brothers had.

Mr. MCDONOUGH. The ultimate thing in all the tests is the protection of the man.

Mr. GLENN. Yes, sir.

Mr. SCHIRRA. I would like to make one remark. The Wright brothers had only a two-sided coin to worry about, but we have a seven-sided coin to worry about for the first flight.

Mr. MCDONOUGH. What do you mean?

Mr. SCHIRRA. Which one goes first. We won't have the choice.

The CHAIRMAN. Mr. Roush. We are going to have to cut the meeting a little short, so I will recognize Mr. Roush and then Mr. King—he hasn't been recognized—and then we had better plan on closing.

Mr. ROUSH. Mr. Chairman, I am directing my questions to just one of the astronauts. I will pick the man I have something in common with—Captain Grissom.

We have been talking in terms of orbiting the earth a couple of times. I believe, however, Captain Grissom, that that is not what the committee is thinking of ultimately. We are thinking in terms of space travel whereby we might go to the Moon or Mars. I am wondering if you have also thought in those terms?

Mr. GRISSOM. Surely. We have thought in terms of extending this on out farther—to the Moon and other planets—but there has to be a first step and we feel this is the first step.

Mr. ROUSH. If you make that first step, Captain, then you will feel that you should be the man to go to Mars or to the Moon?

Mr. GRISSOM. Certainly.

Mr. ROUSH. That is all, Mr. Chairman.

The CHAIRMAN. Mr. King.

Mr. KING. You gentlemen, of course, are all young and in the peak of health, but you are still past that first blush of reckless youth in the late teens and early twenties. I assume that that was all thought out and you are in the age bracket that you are in because it was felt that a little more maturity, stability, and experience behind you became an important factor, especially because of the psychological

problems involved. Would any one of you like to discuss that for just a minute?

Mr. SHEPARD. We, of course, had nothing to do with determining the criteria upon which the selection was made, as you are aware. The criteria were established by the NASA. Of course, we all agree with it, obviously. Maturity, past experience, I think are very important considerations—were very important considerations when NASA established the criteria.

Mr. KING. The pilots in their early twenties are apt to be just a little reckless, I suppose, and lack just some of the maturity that you would get after 10 years of experience?

Mr. SHEPARD. I would rather not speak to the point of how much recklessness or lack thereof was considered because that decision was made by the NASA.

Mr. KING. At least all of you have established a record. Obviously it is a good record, and a record of maturity. So in picking you they are not picking an unknown quantity.

Mr. SHEPARD. That is right.

Mr. KING. I am sure that was an important factor.

Mr. GLENN. One comment on that. I think the criteria were established, and I think as far as the age group went, I think it just happened that if anybody had all these qualifications they probably had been around long enough and had done enough test flying and had had enough tours of service at different places that to get the qualified men that they wanted, you just didn't get this kind of experience until you got to be in our age.

In other words, I don't think if they had had a man that was as highly motivated and qualified at 20 years of age and had had all the experience he probably would have been selected too, but you just couldn't get that experience in that short a time.

The CHAIRMAN. Mr. Miller.

Mr. MILLER. No questions. I would just like to compliment these men. I think the fact that they have all been test pilots and all of them have had 2,000 or more hours in the air indicates that that recklessness is gone. It is also evidenced by the very fact that they are alive. I want to congratulate them.

The CHAIRMAN. In line with Mr. Miller's questions, how long since you began test flying?

Mr. SHEPARD. I started flying in 1946. I started test pilot work initially in 1950.

The CHAIRMAN. Well, I understand it is all in the pamphlet so there is no use to go into that in detail.

I want to thank everybody. Mr. Sisk, you came in late. Do you have a question?

Mr. SISK. I simply want to observe, Mr. Chairman, that apparently these men run true to form. Now, we have about 15 million people in California. It is a little hard to find a native-born Californian. I don't find one among this group. So I assume they run true to form.

Mr. MILLER. In this case, Colorado has two.

Mr. CHENOWETH. We are making up for California.

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Mr. QUIGLEY. Mr. Chairman, could I ask just one question?

The CHAIRMAN. Surely.

* * * * * * *

The CHAIRMAN. How would that compare with the X–15?

Mr. LOW. I am not qualified to answer on the X–15 program. I am not closely connected with it and I don't know what the time schedule is on that.

The CHAIRMAN. Thank you all very much. We do appreciate the NASA giving the committee the privilege of meeting these men here. We appreciate their having the opportunity to visit with us. We would like to extend it indefinitely. We know you are not here as witnesses.

Mr. CHENOWETH. Mr. Chairman.

The CHAIRMAN. Mr. Chenoweth.

Mr. CHENOWETH. One brief question.

I was intrigued with the ages of these men. I notice the youngest is 32 and the oldest 39. In between there is about 34 or 35. Is there something about that particular age group? I notice they all run about the same——

Mr. LOW. I think the answer that Mr. Glenn gave a few minutes ago applies to this also—that first of all we set the upper age limit to 40.

Mr. CHENOWETH. You set an age limit?

Mr. LOW. We set an upper age limit where the man had to be less than 40.

Mr. CHENOWETH. How about a minimum age?

Mr. LOW. We set no minimum, but by the time the men have the type of experience we were looking for, the highly qualified jet test pilot, they have reached an age of apparently at least 32 or more likely 35 or 37.

The CHAIRMAN. We certainly thank you gentlemen for being here. We have appreciated this opportunity of meeting and talking with you. We will follow your careers with a great deal of interest.

This committee will help wherever we can be of assistance to you and to NASA.

Thank you very much.

(Whereupon, at 11:14 a.m., the committee proceeded to further business.)

STAFF REPORT ON ACTIVITIES OF ASTRONAUTS AT LANGLEY FIELD, VA.

On July 9, 1959, as a result of conflicting newspaper reports concerning the activities of the seven astronauts in training for Project Mercury, the Committee on Science and Astronautics decided to send a staff representative to Langley Field, Va., for an on-the-spot check.

According to one newspaper report, the morale of the astronauts was, by implication, being seriously affected by certain problems that arose in their training program. These problems were mainly concerned with reimbursement for per diem expenses incurred during official trips away from their base and their inability to maintain their piloting skills in high-speed aircraft.

The staff representative interviewed the astronauts July 10 and on July 14 submitted to the chairman a report on his findings, which follows:

"Mr. Chairman, as a result of recent conflicting newspaper articles dealing with the present status of the NASA astronauts and which aroused the concern of the committee with regard to their morale, the committee directed that a staff member be sent to Langley Field, Va., where the seven officers are in training, to determine the true facts pertaining to their program.

"My interviews with the astronauts were very informal and uninhibited by any attitudes or postures. I assured them that no information furnished me would be attributed to them individually and tried to develop a cordial and easy atmosphere in which to convey the deep concern of your committee with their welfare.

"All were very candid and responsive. They assured me with unqualified emphasis that their morale is of the highest degree, and they ridiculed the implication by the newspapers that they were unhappy with the project. They demonstrated to me that they were men of high professional competence, that they would not exchange their assignment for any other under any circumstances, and that their enthusiasm for Project Mercury was undiminished.

"I directed several specific questions to each that were sponsored by items appearing in the press, such as the delay in getting their per diem reimbursements for the many trips they had to take and the lack of airplanes to maintain piloting skills. In addition, I queried whether they were getting sufficient 'think time' away from the project, what was the status of their relationship to parent services, were they satisfied with NASA support, and was there an excessive demand on their time for public relations or press purposes.

"First, the question of reimbursement has never been a personal problem. True, there have been delays in the past, but only due to a heavy clerical load that slowed the processing of vouchers. This load has been eased and as a consequence inordinate delays in payment have been eliminated. Further, any per diem expenses can be furnished in advance by NASA, if it is desired by any astronaut.

"Second, the question of not having proper airplanes is a matter of active concern with each man, but has no reflection on morale whatsoever. In substance, they believe that they have an unquestionable need for high-speed, high-performance jet aircraft, such as the F–104B in order to (*a*) produce conditions of flight similar to those they will experience in the Mercury capsule, such as weightlessness, living for prolonged periods in a pressure suit, and the like; and (*b*) to maintain their abilities in high-speed orientation and reflex actions which each had acquired as service test pilots and will need at a high level of competence for the Mercury capsule flights.

"Now, there apparently is no difficulty about obtaining these airplanes. The principal difficulty centers in obtaining the necessary ground support and maintenance services that are not properly available at Langley Air Force Base.

"Each one believed that this difficulty can be resolved through contractor maintenance; that is, a NASA contract with a firm specializing in maintaining jet and conventional aircraft would be an excellent means of providing this support.

"The astronauts cited a need for another type airplane. The control of the orbiting Mercury capsule will be by means of instruments, not by visual reference. Hence, there is a definite requirement for continuous training in the use of flight instruments that cannot feasibly be obtained in jet aircraft because of their low endurance, high altitude performance. They believe that one or two smaller conventional aircraft like the Aero Commander, twin Cessna, or twin Beechcraft would be ideal for this, allowing longer periods of instrument flight under much less hazardous conditions. Furthermore, each astronaut spends about 40 hours a month in commercial airliners on relatively short trips about the country. This is unproductive time for them. It is believed that the smaller aircraft would provide them the means to utilize this flight time for training and also permit more efficient scheduling of study.

"Third, there is no doubt that the intense, varied, and concentrated training undertaken by the astronauts, demands that a certain amount of time off should be scheduled periodically, just to allow the men to digest what they have assimilated. They all agreed that up to the present time, they have not had sufficient 'think time,' because the project is still fairly new. However, they expect in the near future to be allowed to schedule their time more openly, and allow for this free time to talk and think.

"Incidentally, it was discovered during this line of interrogation that each of the astronauts has recently assumed responsibility for developing a specific technical field directly related to the project. Thus, each astronaut becomes the leading project officer in his particular specialty for the group. Assignments of areas include the Redstone booster, the Atlas, life sciences, environment, and so forth.

"Fourth, with regard to their relationship to the Air Force or the Navy, there were mixed opinions as to how the administrative details should be handled, but one has a strong feeling about this. It was felt that it was an administrative decision for NASA to make, and insofar as their military careers were concerned, the astronauts had no qualms about their future.

"In summation, the following facts are evident:

"(*a*) The morale of the astronauts is of the highest degree.

"(*b*) There are some areas in which it is believed that some improvement is needed. These convictions are the product of their professional judgment and in no way related to their morale.

"(*c*) The astronauts are fully aware of their responsibilities to the project and the American public, particularly with regard to the heroic role they are beginning to assume with the young people of the country. They have imposed upon themselves strict rules of conduct and behavior, which credits them with constructive and mature evaluation of their position as the cynosure of all eyes.

"I was deeply impressed by the high level of their professional attitude. I am confident that the relationship between the astronauts and the NASA project leaders is harmonious and effective. As the project progresses, I believe that a continuing demonstration of the deep interest of the committee in the astronauts and the project will materially contribute to the success of the Mercury flights.

"Respectfully yours,

"RICHARD P. HINES, *Staff Consultant.*"

APPENDIX

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION,
Washington, D. C.

MERCURY ASTRONAUT SELECTION FACT SHEET

BACKGROUND

Many of the conditions expected in orbital space flight are similar to those experienced by military test pilots. NASA, therefore, went to this field to seek volunteers for the Mercury astronaut training program. More than 100 military test pilots met the general qualifications. Of these, 69 were interviewed in Washington, D.C., and 80 percent volunteered to proceed. Personal consultations and interviews followed, and the list of candidates was narrowed to 32.

In this initial phase, and in the following selection steps, evaluation was extremely difficult because of the high caliber and motivation of the candidates. During the course of the selection program it was determined that seven is the optimum number of Mercury astronauts so that each can have full participation in all phases of the Mercury development.

PHYSICAL FITNESS

Immediately following their Washington interviews the candidates were assigned to groups, five of six men each and one of two. One group at a time reported to the Lovelace Clinic in Albuquerque, N. Mex., for an exhaustive series of examinations. The other men returned to their home stations to await the call for their groups. The first contingent entered Lovelace February 7, and the others on succeeding Saturdays. Each candidate spent 7½ days and 3 evenings at the Lovelace facility.

General physical requirements were established by the NASA Life Sciences Committee; since all those examined are active test pilots it was not anticipated that any would be disqualified as physically unfit. Rather, degrees of physical soundness were obtained and evaluation was dependent upon a comparison of each man to his fellow candidates.

To establish a comparative yardstick, the Lovelace program began with a complete aviation and medical history and extended to these areas:

Hematology and pathology (blood and study of tissues)
Roentgenology (X-ray consultations)
Ophthamology (eyes)
Otorhinolaryngology (ears, nose, and throat)
Cardiology (heart and circulation)
Neurology and myology (nerves and muscles)
General internal medicine
Related laboratory studies

Special consultations were provided if indicated by the candidate's medical history or any of the general examinations. These examinations were given under normal clinical procedures, while the subject was in a resting condition. To assess the candidate's abilities under load, Lovelace physicians developed a series of dynamic tests which were used for the first time in the Project Mercury selection process.

Capacity under load, or body efficiency, was determined from a correlation of the subject's physical competence with his pulmonary function, total body radiation count, specific gravity of the body, blood volume, water volume, lean body mass, and detection of tiny congenital openings between the chambers of the heart.

Results of the static and dynamic tests were recorded on special computing cards developed by the Lovelace Clinic for the astronaut program. These cards

are mark-sensed so they may be read directly by the examining physician and contain the candidate's complete aviation and medical histories and examination findings.

Psychological and Stress Evaluation

The next step in the selection process was a minute determination of the candidate's psychological makeup and an estimate of his ability to cope with stresses expected in space flight.

Basis for this part of the selection took into consideration previously developed studies made in anticipation of the need for a program to select and precondition pilots for extreme-high-altitude flights. The program was tailored to meet the specific requirements foreseen for orbital flight.

The Air Force, with the assistance of Army and Navy specialists, conducted psychological and stress measurements at the Wright Air Development Center Aeromedical Laboratories, Wright-Patterson Air Force Base, Dayton, Ohio. The examinations were in these general areas:

Personality evaluation
Behavioral sciences
Stress and fatigue
Accelerative forces
Equilibrium and vibration
High energy noise
Low barometric pressure
Thermal stress
Anthropology

Testing at WADC was conducted with candidates in six groups of five men each and one group of two. The first group entered February 15; each man was evaluated 6 days and 3 evenings.

A complex appraisal of both clinical and statistical test results went into the WADC evaluation of candidates. As in the case of the Lovelace examinations, results were not a matter of passing or failing, but instead were measures of how one candidate compared with all others.

Because manned satellite flight is without precedent, Mercury astronauts will be pioneers not only in space flight but also in the development of a program which will determine qualities best suited for such special missions.

Final Selection

Data from the Lovelace and WADC examinations were compiled and forwarded to the NASA Space Flight Activity, Langley Field, near Hampton, Va., for the fourth and final step in the selection process. At Langley, a group representing both the medical and technical fields evaluated the previous examinations. The seven ultimately selected were chosen as a result of physical, psychological, and stress-tolerance abilities and because of the particular scientific disciple, or specialty, each represents.

Clinical Examinations Given by the Lovelace Clinic

Medical history and physical examination, including internal examinations and orthopedic or other specialty consultations as indicated.

Laboratory tests: Hemoglobin (measure of oxygen-carrying red pigment); hematocrit (examination of blood by use of a centrifuge); grouping; Rh factor; serology (examination of blood serums); sedimentation rate (analysis of urine deposits); stool examinations; urinalysis; gastric analysis; cholesterol (substance present in gallstones, heart ailments, etc.); liver function test; urinary steroid excretion (measure of the hormones, acids, and poisons); blood nitrogen; blood protein; protein-bound iodine; special serum studies; throat culture; chemical examination of body outputs; and blood counts.

X-rays: Chest, large intestine, sinuses, spine, stomach, esophagus, teeth, and heart. Moving pictures were taken of the heart to determine any artery calcification.

Eyes: History, dilation, visual fields, tonometry (measure of inner pressure on the eyes), slit lamp, dynamic visual acuity, depth perception, night vision, and photography of conjunctival vessel (eye membrane) and retina.

Ears, nose, and throat: Examination of throat and nasal passages; audiogram with and without background noises; speech discrimination and voice tape recording.

Heart: Cardiograms of heart-muscle contraction, heart-stroke volume and heart sounds; measure of the chest which overlies the heart.

Nerves and muscles: General neurologic examination with muscle testing; electric stimulation of the nerves to determine response; measure of any nerve abnormality; tracing of electric currents produced by the brain.

Special Dynamic Examinations Given by the Lovelace Clinic To Measure Body Efficiency

Physical competence: Measured by an ergometer, a device similar to a bicycle. Subject pedals increasing amount of weight while wearing an oxygen mask. Heartbeat and oxygen consumption determined. Evaluation is made by the amount subject can pedal by the time his heart reaches 180 beats per minute.

Pulmonary function: Lung capacity and breathing efficiency determined by measuring the amount of oxygen subject breathes normally and during exercise.

Lean body mass: A correlation of the following:

Total body radiation count, conducted by the Atomic Energy Commission, Los Alamos Laboratories, to determine the amount of potassium in the body.

Specific gravity, weighing the subject in air and while he is totally immersed in water.

Blood volume, measured by inhaling a small amount of carbon monoxide and observing the amount absorbed by the blood after a specified time.

Water volume, determined by swallowing a small amount of tritium and observing its rate of dilution.

Presence of heart-chamber openings: Amount of blood oxygen is measured during and after a Valsalva maneuver. The Valsalva exercise is accomplished by blocking the nose and blowing into a tube.

Stress Tests Conducted at the Wright Air Development Center

Harvard step: Subject steps 20 inches to a platform once every 2 seconds for 5 minutes to measure his physical fitness.

Treadmill maximum workload; Subject walks at a constant rate on a moving platform which is elevated 1° each minute. Test continues until heart reaches 180 beats per minute. Test of physical fitness.

Cold pressor: Subject plunges his feet into a tub of ice water. Pulse and blood pressure measured before and during test.

Complex behavior simulator: A panel with 12 signals, each requiring a different response. Measure of ability to react reliably under confusing situations.

Tilt table: Subject lays on steeply inclined table for 25 minutes to measure ability of the heart to compensate for body in an unusual position for an extended time.

Partial pressure suit: Subject is taken in pressure chamber to a simulated altitude of 65,000 feet in an MC1 partial pressure suit. Test lasts 1 hour. Measure of efficiency of heart system and breathing at low ambient pressures.

Isolation: Subject goes into a dark, soundproof room for 3 hours to determine his ability to adapt to unusual circumstances and to cope with the absence of external stimuli.

Acceleration: Subject is placed in a centrifuge with his seat inclined at various angles to measure his ability to withstand multiple gravity forces.

Heat: Subject spends 2 hours in a chamber with the temperature at 130° F. to measure reaction of heart and body functions while under this stress.

Equilibrium and vibration: Subject is seated on a chair which rotates simultaneously on two axes. He is required to maintain the chair on an even keel by means of a control stick with and without vibration, normally and while blindfolded.

Noise: Subject is exposed to a variety of sound frequencies to determine his susceptibility to tones of high frequency.

Psychological Tests Administered by Wright Air Development Center

To determine personality and motivation: Interviews; Rorschach (ink blot); apperception (tell stories suggested by pictures); draw a person; sentence completion; self-inventory based on 566-item questionnaire; officer effectiveness inventory; personal preference schedule based on 225 pairs of self-descriptive statements; personal inventory based on 20 pairs of self-descriptive statements; preference evaluation based on 52 statements; determination of authoritarian attitudes, and interpretation of the question, "Who Am I?"

To determine intelligence and special aptitudes; Wechsler adult scale; Miller analogies; Raven matrices; Doppelt mathematical reasoning test; engineering analogies; mechanical comprehension; officer qualification test; aviation qualification test; space memory; spatial orientation; hidden figures perception; spatial visualization, and peer ratings.

Members of NASA Life Sciences Committee

Chairman, Dr. W. Randolph Lovelace II, director of the Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.; members: Capt. Norman L. Barr (MC), Director, Astronautical Division, Navy Bureau of Medicine and Surgery, Washington, D.C.; Lt. Comdr. John H. Ebersole (MC), medical officer, U.S.S. *Seawolf*, Fleet Post Office, New York, N.Y.; Brig. Gen. Donald D. Flickinger (MC), Surgeon and Assistant Deputy Commander for Research, Headquarters, Air Research and Development Command, Washington, D.C.; Lt. Col. Robert H. Holmes (MC), Chief of Bio Physics and Astronautics Branch, Army Medical Research and Development Command, Washington, D.C.; Dr. Wright H. Langham, Los Alamos Scientific Laboratory, University of California; Dr. Robert B. Livingston, Director of Basic Research in Mental Health and Neurological Diseases, National Institutes of Health, Bethesda, Md.; and Dr. Orr Reynolds, Director of Science, Office of the Assistant Secretary of Defense for Research and Engineering, Washington, D.C. Boyd C. Myers II, NASA Headquarters, is secretary of the committee.

SPACE TASK GROUP FACT SHEET

I. Background

The Space Task Group is a unit of the National Aeronautics and Space Administration located at the NASA's Langley Research Center, Hampton, Va. The group came into existence in the fall of 1958 with specific responsibility for putting a manned satellite into orbit with subsequent safe recovery. During the year preceding formation of the task group, several members of the Langley staff had conducted experimental and theoretical studies into problems of manned space flight.

Dr. T. Keith Glennan, NASA Administrator, ordered that the task group be organized, and the Langley Center released a number of scientists to the group. These men formed its nucleaus. The Space Task Group is a component which reports directly to NASA Space Flight Development in Washington.

II. Organization

The group is headed by a Project Director Robert R. Gilruth, who was an Assistant Director of the Langley Research Center before he was appointed to his present post. Assistant Project Director is Charles J. Donlan. Paul E. Purser is special assistant to the director.

Chief of the Operations Division is Charles W. Mathews. Maxime A. Faget heads the Flight Systems Division. Charles H. Zimmerman is Chief of the Engineering and Contract Administration Division.

(Note.—Part V of this pamphlet contains biographies of the above-named scientists.)

Scope of the Operations Division includes launching, recovery, ground support, and developmental testing.

The Flight Systems Division conducts work on a parallel with systems application, and its responsibility involves heat shielding, structures, navigation, rocket boosters, escape, life support, and systems integration.

Area of the work within the Engineering and Contract Administration Division is design engineering, specifications, contract negotiation, and contract monitoring.

Continuous informational liaison is maintained with the Defense Department, through the Advanced Research Project Agency, and with the Lovelace Aeromedical Committee.

Also within the Space Task Group is a staff of human-factors consultants, all of whom have extensive experience in the selection and training of men for special missions in fields such as research air crews and nuclear-propelled submarine crews.

III. Facilities Available To Implement Program

The Space Task Group is calling on facilities of the NASA, the Armed Services, universities, and industry in the Project Mercury program.

Much basic and developmental research is being conducted at NASA centers in aerodynamics, structures, guidance, stability, and control and flight support.

Human factors facilities in such fields as weightlessness and high acceleration and deceleration are being furnished by the Department of Defense.

Industrial resources will fabricate the capsule and equip it for its flight. The McDonnell Aircraft Co. of St. Louis, Mo., was selected prime contractor for the space capsule in January 1959.

IV. Future Projects

Project Mercury is a basic stepping stone in development of space exploration techniques. Because the project is without precedent, no time schedule can be given for accomplishing the required developmental programs. Logically, man's initial orbital flight will be followed by research to refine performance, much the same as is done in aircraft research.

Once it has been conclusively demonstrated that man can exist in the environment of outer space, it is likely that the program will extend to sending two men into orbit, then a team. Scientists foresee construction of an orbiting space laboratory and development of a method of ferrying personnel and equipment to this station.

BIOGRAPHIES OF ASTRONAUTS

ALAN BARTLETT SHEPARD, JR.

Alan B. Shepard, Jr., a lieutenant commander in the U.S. Navy, was born November 18, 1923, in East Derry, N.H. The 35-year-old astronaut is 5 feet 11 inches tall, weighs 160 pounds, and has blue eyes and brown hair. His parents, Col. and Mrs. Alan B. Shepard, live in East Derry, where the elder Shepard, a retired officer of the U.S. Army, is an insurance broker. Shepard is married to the former Louise Brewer of Kennett Square, Pa. The couple has two daughters, Juliana, 8, and Laura, 12. Shepard's sister, Mrs. Pauline S. Sherman, resides in Montclair, N.J.

Shepard attended primary school in East Derry and was graduated from Pinkerton School, Derry, N.H., in 1940. He studied 1 year at Admiral Farragut Academy, Toms River, N.J., and then entered the Naval Academy, Annapolis. He was graduated from Annapolis in 1944. He was graduated from the Naval War College, Newport, R.I., in 1958.

The astronaut saw service on the destroyer *Cosgrove*, in the Pacific during World War II. He then entered flying training at Corpus Christi, Tex., and Pensacola, Fla. He received his wings in March 1947. Subsequent service was in Fighter Squadron 42 at the Norfolk Naval Air Station and Jacksonville, Fla. He also spent several tours in the Mediterranean. Shepard went to test pilot school at Patuxent River, Md., and served two tours in flight test there. During this service he took part in high-altitude tests to obtain data on light at different altitudes and in a variety of air masses over the North American Continent. He also took part in experiments in test and development of the Navy's in-flight refueling system; carrier suitability trials of the F–2H3 Banshee, and Navy trials of the first angled carrier deck. Between his flight test tours at Patuxent, Shepard was assigned to Fighter Squadron 193 at Moffett Field, Calif., a night fighter unit flying Banshee jets. He was operations officer of this squadron and made two tours with it to the Western Pacific on board the carrier *Oriskany*. He has been engaged in the test of the F–3H Demon, F–8U Crusader, F–4D Skyray, and F–11F Tigercat. He was project test pilot on the F–5D Skylancer. The last 5 months at Patuxent were spent as an instructor in the test pilot school. After his graduation from the Naval War College, Shepard joined the staff of the commander in chief, Atlantic Fleet, as aircraft readiness officer. He has 3,600 hours of flying time, 1,700 in jets.

Shepard's hobbies are golf, ice skating, and water skiing.

VIRGIL IVAN GRISSOM

Virgil I. Grissom, a captain in the U.S. Air Force, was born April 3, 1926, in Mitchell, Ind., Five feet 7 inches tall, he weighs 155 pounds and has brown eyes and brown hair. His parents, Mr. and Mrs. Dennis D. Grissom, live at 715 Baker Street, Mitchell. He has two brothers: Norman, of Mitchell, and Lowell, a sophomore at Indiana University; and a sister, Mrs. Joe Beavers of Baltimore. Mrs. Grissom is the former Betty L. Moore. Her father, Claude Moore, lives in Mitchel. Her mother is deceased. The Grissoms have two sons: Scott, 9, and Mark, 5.

Grissom attended primary and high schools in Mitchell and was graduated from Purdue University with a degree in mechanical engineering in 1950.

He first entered the Air Force in 1944 as an aviation cadet. He was discharged in November 1945. He returned to aviation cadet training after his graduation from Purdue, and he received his wings in March 1951. Grissom joined the 75th Fighter-Interceptor Squadron at Preque Isle, Maine, as an F–86 fighter pilot. He flew 100 combat missions in Korea in F–86's with the 334th Fighter Interceptor Squadron. He left Korea in June 1952 and became a pilot instructor at Bryan, Tex. In August 1955 he went to the Air Force Institute

of Technology at Wright-Patterson Air Force Base, Ohio, to study aeronautical engineering. In October 1956 he attended test pilot school at Edwards Air Force Base, Calif., and returned to Wright-Patterson Air Force Base in May 1957 as a test pilot assigned to the Fighter Branch. He has flown more than 3,000 hours, over 2,000 in jets.

Grissom has been awarded the Distinguished Flying Cross and Air Medal with Cluster.

His hobbies are hunting and fishing.

MALCOLM SCOTT CARPENTER

Malcolm S. Carpenter, a lieutenant in the U.S. Navy, was born May 1, 1925, in Boulder, Colo. He now lives at 11911 Timmy Lane, Garden Grove, Calif. His mother is living in Boulder at 5335 Broadway. Carpenter's father, a retired chemist, lives in Palmer Lake, Colo. His wife is the former Rene Louise Price, whose parents, Mr. and Mrs. Lyle S. Price, live at 963 Ninth Street, Boulder. The Carpenters have four children: Mark Scott, 9; Robyn Jay, 7; Kristen Elaine, 3; and Candace Noxon, 2. Carpenter is 5 feet 10½ inches tall, weighs 160 pounds, and has green eyes and brown hair.

After receiving his early education through high school in Boulder, Carpenter entered Colorado College in 1943 to participate in the V–5 flight-training program sponsored by the U.S. Navy. After a year there, he spent 6 months in training at St. Mary's Preflight School, Moraga, Calif., and 4 months in primary flight training at Ottumwa, Iowa. When the V–5 program ended at the close of World War II, Carpenter entered the University of Colorado to major in aeronautical engineering. He received a degree there in 1949.

Following his graduation, Carpenter joined the Navy and received flight training from November 1949 to April 1951 at Pensacola, Fla., and Corpus Christi, Tex. He spent 3 months in the Fleet Airborne Electronics Training School, San Diego, Calif., and until October 1951 in a Lockheed P–2V transitional training unit at Whidbey Island, Wash.

In November 1951 he was assigned to Patrol Squadron 6, based at Barbers Point, Hawaii. During the Korean conflict he was engaged with Patrol Squadron 6 in antisubmarine patrol, shipping surveillance and aerial mining activities in the Yellow Sea, South China Sea, and the Formosa Straits. In 1954 he entered the Navy Test Pilot School at the Naval Air Test Center, Patuxent River, Md., and, after completion of his training, was assigned to the Electronics Test Division of the NATC. In this assignment Carpenter conducted flight-test projects with the A–3D, F–11F, and F–9F and asssited in other flight-test programs. He then attended the Navy General Line School at Monterey, Calif., for 10 months and the Naval Air Intelligence School, Washington, D.C., for a further 8 months. In August 1958 he was assigned to the U.S.S. *Hornet*, antisubmarine aircraft carrier, as air intelligence officer. He has accumulated more than 2,800 flying hours, including 300 in jet aircraft.

His hobbies include skin diving, archery, and water-skiing.

DONALD KENT SLAYTON

Donald K. Slayton, a captain in the U.S. Air Force, was born March 1, 1924, in Sparta, Wis. The 35-year-old astronaut is 5 feet 10½ inches tall, weighs 160 pounds, and has blue eyes and brown hair. His parents, Mr. and Mrs. Charles S. Slayton, live in Sparta. A brother, Howard, and sister, Mrs. Lyndahel Hagen, also live in Sparta. Slayton's immediate family also includes a brother Richard, of San Jose, Calif.; another brother, Elwood, and two sisters, Mrs. Milton Madsen and Mrs. Harold Schluenz, all of Madison. His wife is the former Marjorie Lunney, daughter of Mr. and Mrs. George Lunney of Los Angeles, Calif. The Slaytons have one son, Kent, 2.

Slayton attended primary and high schools in Sparta, graduating from Sparta High School in 1942. He entered the University of Minnesota in January 1947, and was graduated with a degree in aeronautical engineering in August 1949.

He entered the Air Force as an aviation cadet in 1942 and after instruction at Vernon, Tex., and Williams, Ariz., won his wings in April 1943. He flew 56 combat missions in B–25's in Europe with the 340th Bombardment Group (Medium). In mid-1944, he returned to this country as a B–25 instructor pilot

at Columbia, S.C., and then served with a unit checking out pilots in the A-26. He joined with 319th Bombardment Group (Medium) and went to Okinawa in April 1945, where he flew seven combat missions over Japan. He was an instructor pilot in B–25 aircraft for about a year after the war. Following his graduation from the University of Minnesota, he was an aeronautical engineer with Boeing Aircraft Co. in Seattle, Was., until recalled in early 1951 to active duty with the Air National Guard, in which he maintained membershp during his student days at the University of Minnesota. On his recall, he was assigned to Minneapolis as maintenance flight test officer of an F–51 squadron. He then spent a year and one-half at 12th Air Force Headquarters as technical inspector, and a like period as fighter pilot and maintenance officer with the 36th Fighter Day Wing in Bitburg, Germany. He returned to the United States in June of 1955 and attended the Air Force Flight Test Pilot School at Edwards Air Force Base, Calif. Since January 1956 he has been an experimental test pilot at Edwards, where he has flown all jet fighter-type aircraft built for the Air Force. His last assignment was Chief of Fighter Section A. He has 3,400 flying hours, 2,000 in jets.

Slayton holds the Air Medal with cluster.

His hobbies are hunting, fishing, shooting, archery, photography, and skiing.

WALTER MARTY SCHIRRA, JR.

Walter M. Schirra (Shi-RAH), Jr., a lieutenant commander in the U.S. Navy, was born March 12, 1923, in Hackensack, N.J. The 36-year-old astronaut is 5 feet 10 inches tall, weights 185 pounds, and has brown hair and brown eyes. His parents, Mr. and Mrs. Walter M. Schirra, reside in Honolulu, Hawaii, where the older Schirra is a civil engineer with the Air Force. The senior Schirra was a World War I ace in the Army Air Corps. After the war, he and his wife barnstormed throughout the Eastern United States in a light plane. The astronaut's wife is the former Josephine C. Fraser of Seattle, Wash. The couple has two children: Walter III, 8; and Suzanne Karen, 1. Mrs. Schirra is the daughter of Mrs. James L. Holloway, wife of Admiral Holloway, who was commander in chief of the Northeastern Atlantic and Mediterranean area. Schirra also has a sister, Mrs. John H. Burhans, who lives in Patuxent River, Md.

Schirra attended primary and junior high schools in Oradell, N.J. He was graduated from Dwight Morrow High School, Englewood, N.J., in 1940, and attended Newark, N.J. College of Engineering 1 year. He was graduated from the U.S. Naval Academy in 1945.

Schirra has had service on board the battle cruiser *Alaska*, the staff of the 7th Fleet, flight training at Pensacola, in a Navy fighter squadron (71) and as an exchange pilot with the 154th U.S. Air Force Fighter Bomber Squadron. He went with this squadron to Korea, where he flew 90 combat missions in F–84E aircraft. He downed one MIG and has one probable MIG. He took part in development of the Sidewinder missile at China Lake, Calif. He was project pilot for the F–7U–3 Cutlass and instructor pilot for the Cutlass and F–J3 Fury. He flew F–3H–2N Demons as operations officer of Fighter Squadron 124 on board the carrier *Lexington* in the Pacific. He then attended Naval Air Safety Officer School at the University of Southern California, and test pilot training at the Naval Air Test Center, Patuxent, Md. His last assignment was at Patuxent in suitability development work on the F–4H. He has 3,000 hours of flying time, 1,700 hours in jets.

He has been awarded the Distinguished Flying Cross and two Air Medals for his Korean service.

JOHN HERSCHEL GLENN, JR.

John H. Glenn, Jr., a lieutenant colonel in the U.S. Marine Corps, was born July 18, 1921, in Cambridge, Ohio. He considers New Concord, Ohio, his permanent home. He attended primary and high schools in New Concord, and Muskingum College. His parents are Mr. and Mrs. John H. Glenn. The elder Glenn is a retired operator of a plumbing and heating business. Mrs. Glenn is the former Anna Margaret Castor, daughter of Dr. and Mrs. H. W. Castor. The elder Glenns and Castors all live on Bloomfield Road in New Concord. The Glenns have two children: John David, 13; and Carolyn Ann, 12. Glenn also

has a sister, Mrs. Jean Pinkston, of Cambridge. He is five feet 10½ inches tall, weighs 180 pounds and has green eyes and red hair.

Glenn entered the naval aviation cadet program in March 1942. He was graduated and commissioned in the Marine Corps a year later. After advanced training, he joined Marine Fighter Squadron 155 and spent a year flying F–4U fighters in the Marshall Islands. During his World War II service, he flew 59 combat missions. After the war, he was a member of Fighter Squadron 218 on North China patrol and had duty in Guam. From June 1948 to December 1950 he was an instructor in advance training at Corpus Christi, Tex. Glenn then attended Amphibious Warfare School at Quantico, Va. In Korea he flew 63 missions with Marine Fighter Squadron 311 and 27 while an exchange pilot with the Air Force. In the last 9 days of fighting in Korea, he downed three MIG's in combat along the Yalu River. After Korea, Glenn attended test pilot school at the Naval Air Test Center, Patuxent River, Md. After graduation, he was project officer on a number of aircraft, including the F–8U, F–8U–1 and F–8U–P. Since November 1956 he has been assigned to the Fighter Design Branch of the Navy Bureau of Aeronautics in Washington.

Glenn has been awarded the Distinguished Flying Cross on five occasions and he holds the Air Medal with 18 clusters for his service during World War II and Korea. In July 1957, while project officer of the F–8U, he set a transcontinental speed record from Los Angeles to New York, spanning the country in 3 hours 23 minutes. He has more than 5,000 hours of flying time, including 1,500 hours in jet aircraft. Glenn has been attending the University of Maryland during his Washington assignment.

The Glenn family hobbies are boating and water skiing.

LEROY GORDON COOPER, JR.

Leroy G. Cooper, Jr., a captain in the U.S. Air Force, was born March 6, 1927, in Shawnee, Okla. He is 5 feet 9½ inches tall, and weighs 150 pounds. The 32-year-old astronaut has blue eyes and brown hair. He considers as his hometown Carbondale, Colo., where his parents, Col. and Mrs. Leroy G. Cooper, have a ranch. Colonel Cooper is retired from the Air Force. Captain Cooper's wife is the former Trudy Olson of Seatle, Wash. The couple has two daughters: Camala K., 10; and Janita L., 9.

Cooper attended primary and secondary schools in Shawnee, and he attended the University of Hawaii 3 years. He received a degree in aeronautical engineering through the Air Force Institute of Technology at Wright-Patterson Air Force Base, Ohio, in August 1956.

Cooper entered the Marine Corps in 1945 after his graduation from high school. He attended the Naval Academy Preparatory School and was a member of the Presidential Honor Guard in Washington immediately before his discharge in August 1946. While at the University of Hawaii, he received a commission in the Army. He transferred this commission to the Air Force and was recalled by that service for extended active duty in 1949 for flight training.

After his training, he was assigned to the 86th Fighter Bomber Group in Munich, Germany, as an F–84, and later, an F–86 pilot. After his graduation from AFIT, he was assigned to the Air Force Experimental Flight Test School at Edwards Air Force Base, Calif. He was graduated from this school in April 1957, and was assigned duty in the Performance Engineering Branch of the Flight Test Division at Edwards. He conducted flight tests on experimental fighter aircraft. Cooper has 2,300 flying hours, including 1,400 in jets.

His hobbies are photography, riding, hunting, and fishing.

PROGRESS REPORT ON PROJECT MERCURY BY LANGLEY RESEARCH CENTER, LANGLEY FIELD, VA.

Intensive programs of basic and applied research, part of the early phases of Project Mercury, are supplying valuable information leading to a safe and reliable manned satellite capsule.

Project Mercury is the program for putting a manned space capsule into a controlled orbit around the earth, successfully recovering the vehicle, and investigating man's capacity to withstand the environment of space.

The NASA Space Task Group located at the Langley Research Center, Hampton, Va., is administering Project Mercury. Robert R. Gilruth, formerly Assistant Director at Langley, is project director.

In the research programs, conducted in support of the development of the major Mercury subsystems, significant progress is being made as follows in four general areas: air drops, escape, scale-model studies, and impact tests:

Air drops.—Terminal phase of the flight—safe recovery after the Mercury capsule reenters the atmosphere—was an initial consideration of space scientists. Theoretical and experimental studies of this problem were considered by the NASA-Langley Pilotless Aircraft Research Division and the Flight Research Division months before the Space Task Group was formed.

Essentially, the air-drop program tells scientists the optimum altitude at which to deploy the recovery parachute; reliability of the parachute system; motions which can be expected during descent; impact forces in both water and ground landings; and reliable methods of recovery after landing.

Before tests began at the NASA Pilotless Aircraft Research Station, Wallops Island, Va., in the fall of 1958 NASA scientists developed methods for dropping a full-scale model capsule from a CX130 Hercules transport at Fort Bragg, N.C. and over the airfield at West Point, Va.

Full-scale 1-ton test models are staged out of Langley, where capsules are loaded on a Hercules transport loaned the NASA by the USAF Tactical Air Command. The test vehicle dropped into a free fall is photographed in descent by two T–33 chase planes—one flying at the same altitude as the C–130, the other at the altitude where the recovery parachute is deployed.

Two Marine HUS helicopters from Quantico and an NASA crash rescue boat from Wallops Island go to the capsule impact spot. One helicopter, directed by the other HUS and the crash boat, retrieves the capsule by shackling a line to an eye located on top of the test model.

Detailed studies of the entire operation are made from motion-picture films taken by the T–33 jets.

Escape tests.—At launching, the Mercury capsule will have on top of it a pylon-like arrangement tipped with an escape rocket system. If the booster malfunctions at any time from pad to staging an escape rocket can be triggered to carry the capsule and its occupant away from the booster. Normal recovery by parachute then will take place.

Escape system reliability tests and aerodynamic studies of the capsule escape combination are conducted at Wallops Island, where full-scale models are fired to determine proper alinement of escape rocket nozzles as well as dynamic forces on the capsule and escape arrangement during launch and descent.

Model program.—Behavior of the capsule in the air is studied in free flight at Wallops Island and in Langley and NASA Ames Research Center wind tunnels. Plans call for other behavior studies to be conducted at the Arnold Engineering Development Center, Tullahoma, Tenn.

Small capsule models placed on the tips of research rockets and subjected to the full velocity range are used at Wallops to investigate tumbling characteristics, reentry dynamics, and afterbody heating.

In wind tunnels, NASA uses the complete range of scaled-down capsule-booster combinations planned in the buildup program. Example: Buildup flights will be held with the capsule atop a Jupiter rocket; and wind-tunnel research with

scale models is providing answers to control inputs and trajectories through investigations of lift, drag, and static stability of the Jupiter-Mercury arrangement.

At Langley, scientists employ wind tunnels to determine heat transfer and pressure of the heat shield, dynamic stability, afterbody pressures, pressure distribution, and lift and drag. Langley tunnels cover the velocity spectrum from low speed to 11,000 miles per hour.

Ames wind tunnels are used to study panel flutter, pressures and heat transfer, static, and dynamic stability, plus lift and drag in the 390 to 9,950 miles per hour velocity range.

Lift, drag, stability, and pressure distribution studies in the speed range of 325 to 13,000 miles per hour are sheduled at the Arnold Center.

Impact tests.—After its orbital flight, the Mercury capsule will fall at a speed of 30 feet per second. Langley water-drop tests at this velocity show that a safe water reentry can be made with the presently shaped leading face on the capsule.

In the event of a ground landing, scientists are investigating a crushable material which can absorb the landing shock. Honeycombed arrangements of corrugated plastic and aluminum, and fibrous cellulose materials are under study.

In impact tests, scientists are dropping instrumented models in water and on hard surfaces from all impact angles using a variety of materials and arrangements.

THE EXPLORATION OF SPACE

EXCERPTS FROM SPEECH DELIVERED BY HUGH L. DRYDEN, NASA DEPUTY ADMINISTRATOR, APRIL 13, 1959

NASA's long-range objectives include the exploration of the solar system by man himself. Enroute to this objective are the milestones of orbital flight of man in the simplest vehicle (Project Mercury) * * * in advanced maneuverable vehicles, in larger satellites carrying several men, in permanent manned orbiting space laboratories, manned flight to the vicinity of the moon and back, and manned landing on the moon and return.

The objective of Project Mercury is to begin the manned exploration of space by developing the technology needed to place a man in orbit about the earth for a short time and recover him safely, and by studying man's physiological and psychological performance. By restricting the altitude to a height well below the Great Radiation Belt, no heavy shielding is required. By planning for only a few orbits before recovery, existing life support systems are adequate.

* * * the man will travel in a capsule substituted for the nose cone of an intercontinental ballistic missile. The man is supported in a reclining position on a couch for protection against the accelerations imposed by launching and by reentry into the atmosphere. The capsule is provided with equipment to supply oxygen and remove carbon-dioxide, communications and navigation equipment, altitude control jets, heat shield to protect from reentry heating, and a parachute for final landing on water. Reentry is initiated by firing a small rocket to slightly reduce the speed of the capsule in orbit.

The orbiting flight of the first Mercury astronaut will be preceded by extensive tests and qualifications of the capsule and training of the astronaut extending over the next 2 years. Ballistic flights over short distances, instrumented ballistic and orbital flights, animal passenger flights are included in this program of testing and evaluation.

* * * the 7 Mercury astronauts * * * were selected from an original group of 100 military test pilots who met the general qualifications. When 80 percent of the first 69 interviewed volunteered to proceed, the interviews were terminated. The list was then narrowed to 32, who were given extensive physical and psychological tests.

The seven astronauts will receive the most intensive course of training ever offered to a party of prospective explorers. Every conceivable characteristic of space flight, that can be simulated on the ground or in the air, will be made a part of their personal experience. Every detail of the launching, guidance, and tracking procedures will be taught them by ground crews, until they know the operation as we know the working of an office in which we have spent the better part of our professional lives. Only one can be first, but there will be several flights in the program.

All this training of the selected pilots, and all this repeated testing of the rocket and its component parts, are directed toward one end: that the first orbital flight of the Mercury vehicle shall be as nearly routine as human ingenuity and practice can make it. We are determined that the risks to the pilot will be no greater than those experienced during the first flight of a new high-performance airplane.

The Mercury project will be followed by others. In due course a permanent manned satellite will be placed in orbit around the Earth, to conduct research and possibly as a station from which to organize deeper penetrations into space. As we master the required technology we will send an expedition to the Moon, and later on to Mars, to Venus, and to more distant reaches of the solar system.

May I recall to your mind the vast extent of the reaches of space as mapped by the astronomers. The most important object in our part of the universe is the Sun, source of our heat, our light, and in the last analysis our food supply In its neighborhood are nine planets which travel in orbits around the sun and accompany the Sun in its motion through space. The Earth is No. 3, at just the

right distance for our delicate bodies so that we neither roast nor freeze, at a distance of 93 million miles. Our nearest neighbor, as previously mentioned, is the moon, about 240,000 miles away on the average, moving in an orbit about the Earth and accompanying us on our yearly journey around the Sun. The nearest planet to us is Venus, 26 million miles; the next Mars, 49 million miles away. The farthest planet, Pluto, is 3,680 million miles from the Sun.

To comprehend these tremendous distances let us suppose that we now had spacecraft able to travel at 10 miles per second, approximately the initial velocity required to escape from the solar system or 60 times the speed of a jet transport. It would take us 6 hours 40 minutes to travel the average distance to the moon, 24 days to Venus, 58 days to Mars, 108 days to the sun, 11½ years to Pluto.

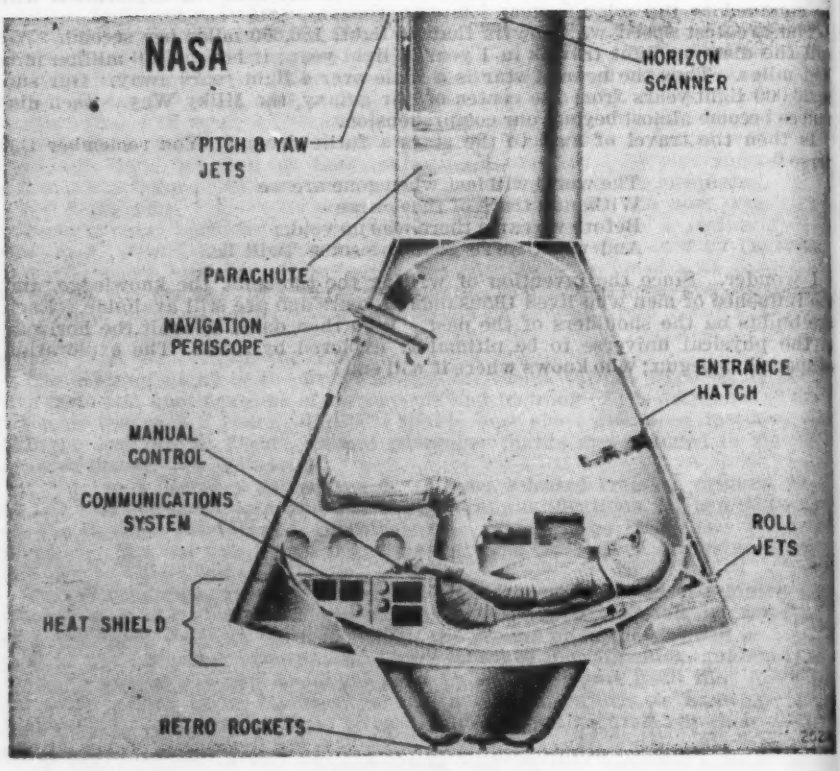
The nearest star is 25 million million miles away, and travel to it at 10 miles per second would require 80,000 years It is evident that our exploration will be confined to the solar system for some time.

The greatest speed we know is that of light, 186,000 miles per second. We call the distance light travels in 1 year, a light-year; it is nearly 6 million million miles. Thus the nearest star is a little over 4 light-years away. Our sun is 26,000 light-years from the center of our galaxy, the Milky Way. Such distances become almost beyond our comprehension.

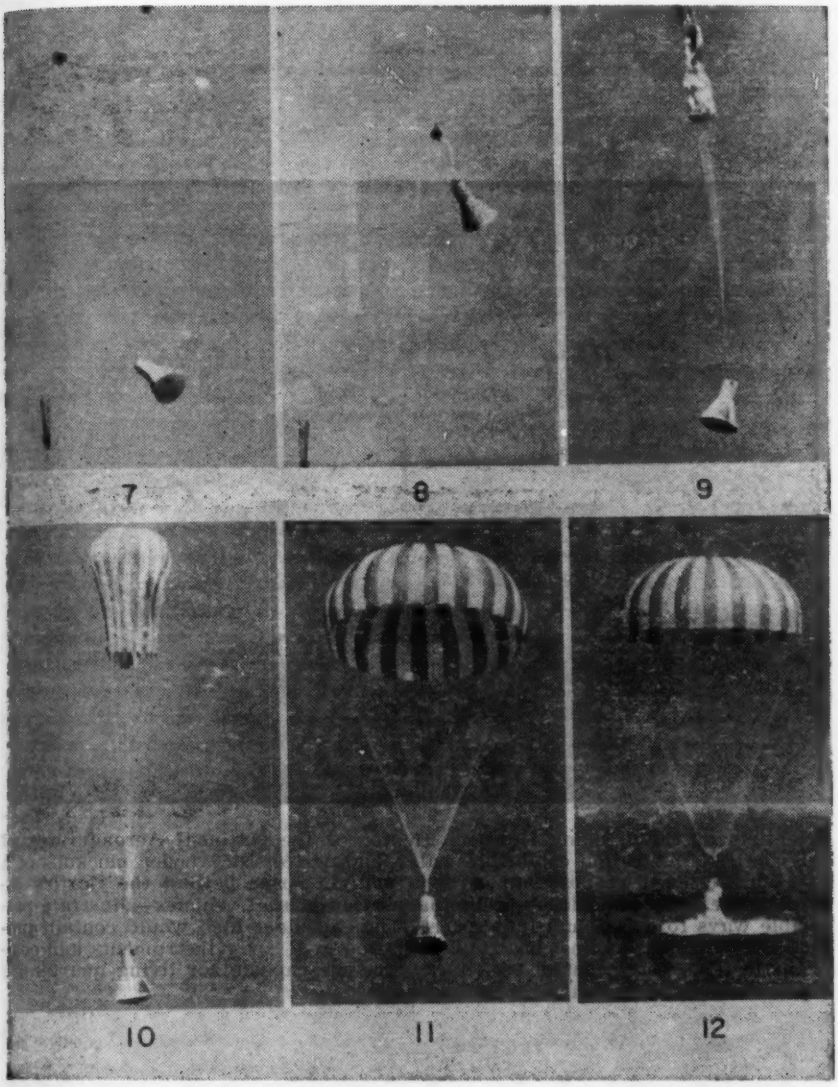
Is then the travel of man to the stars a futile dream? You remember the verse:

> The world will last when gone are we
> Without a trace of thee or me
> Before we came there was no void,
> And when we're gone the same 'twill be.

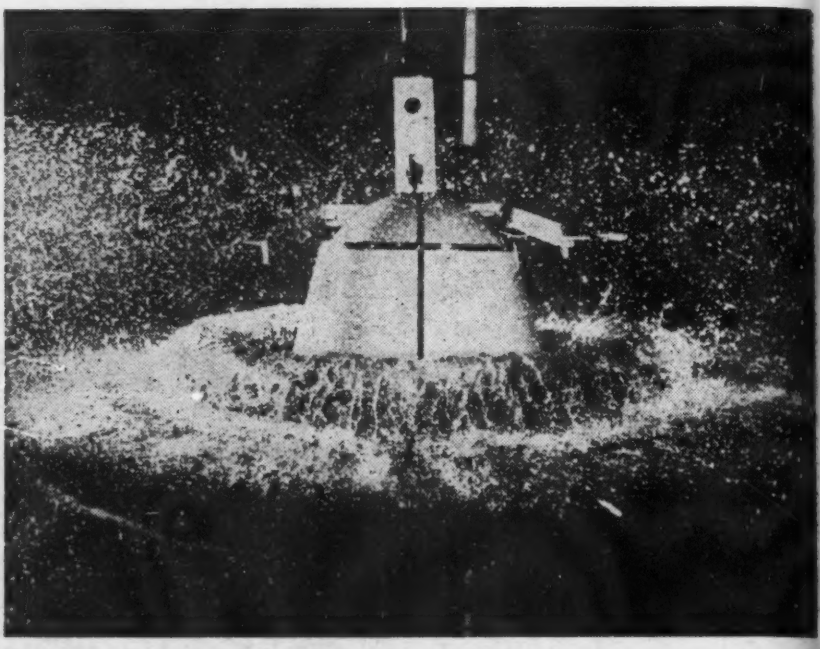
I wonder. Since the invention of writing the thoughts, the knowledge, and the influence of men who lived thousands of years ago are still available. Each age builds on the shoulders of the past. Who then dares to limit the horizons of the physical universe to be ultimately explored by man? The exploration of space has begun; who knows where it will end?



Project Mercury capsule.

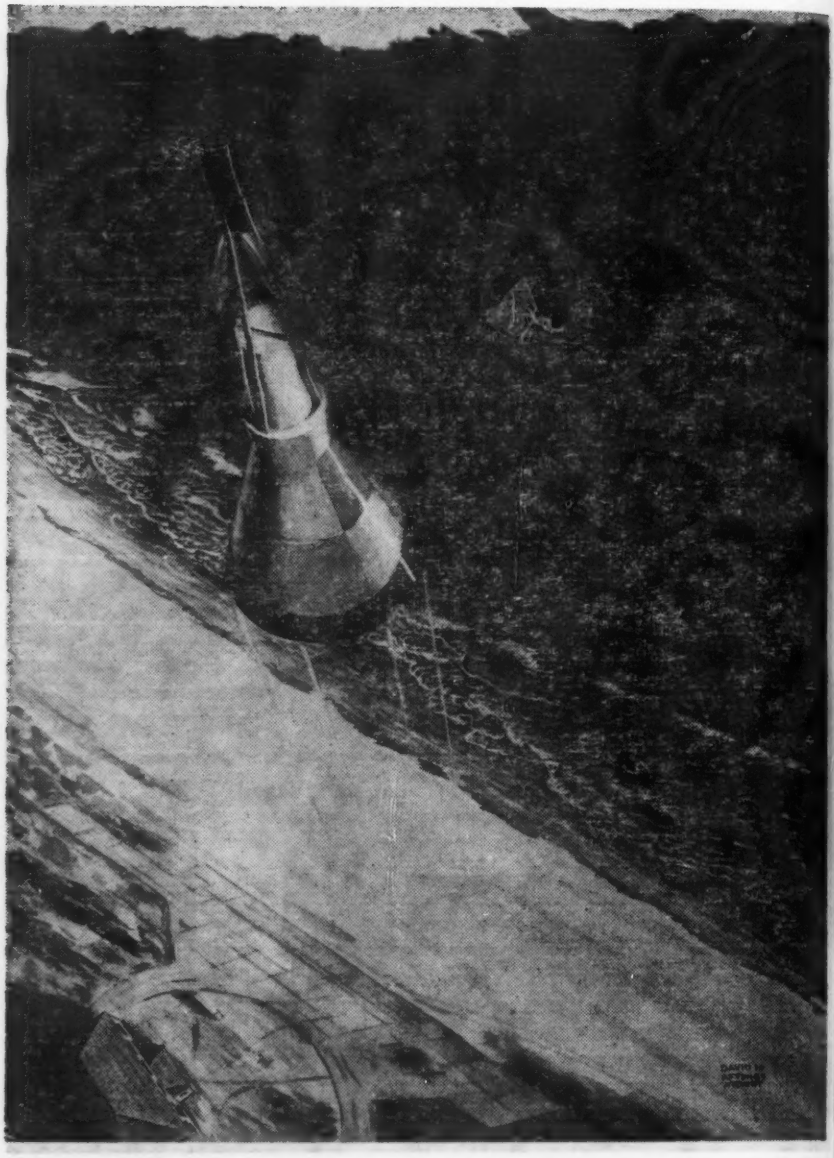


The escape mechanism of the Project Mercury manned orbital capsule is tested at the NASA Pilotless Research Station at Wallops Island, Va. The mechanism is in the tripod arrangement on top of a full-scale "boilerplate" model of the capsule which weighs about 1 ton. In this test, the escape rockets lifted the capsule to 2,250 feet where the tripod was ejected and a parachute lowered the capsule to the water where it was recovered by helicopter.

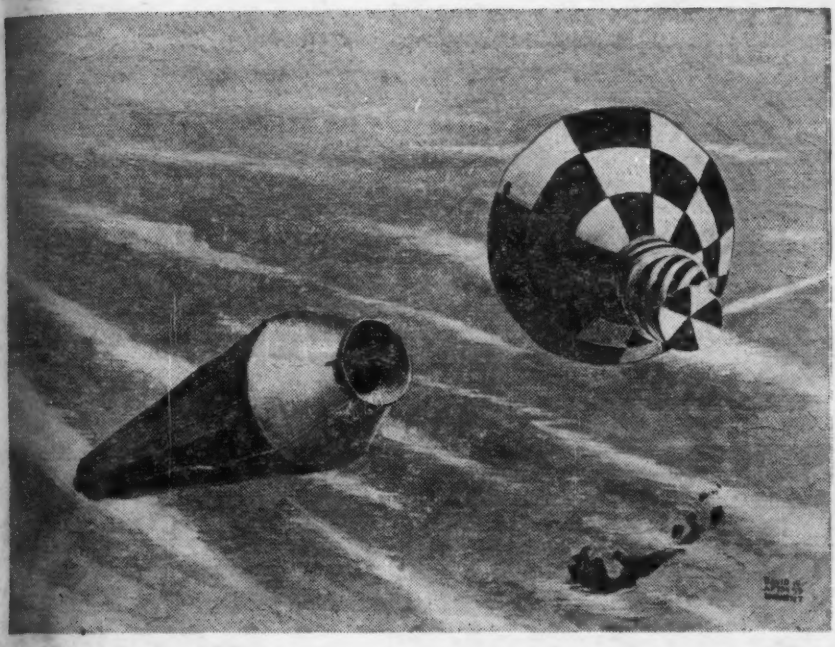


Scientists at the Langley Research Center of the National Aeronautics and Space Administration conducted water-landing tests of wooden mockups of a capsule concept proposed to carry a man in space beyond the Earth's atmosphere. These devices—preliminary experimental vehicles—illustrate possible ways to carry man into space. The capsule, which would contain protective shielding against heat and radiation, will carry instruments and communications gear, control rockets, a pressure capsule for living quarters, a parachute and other survival equipment.

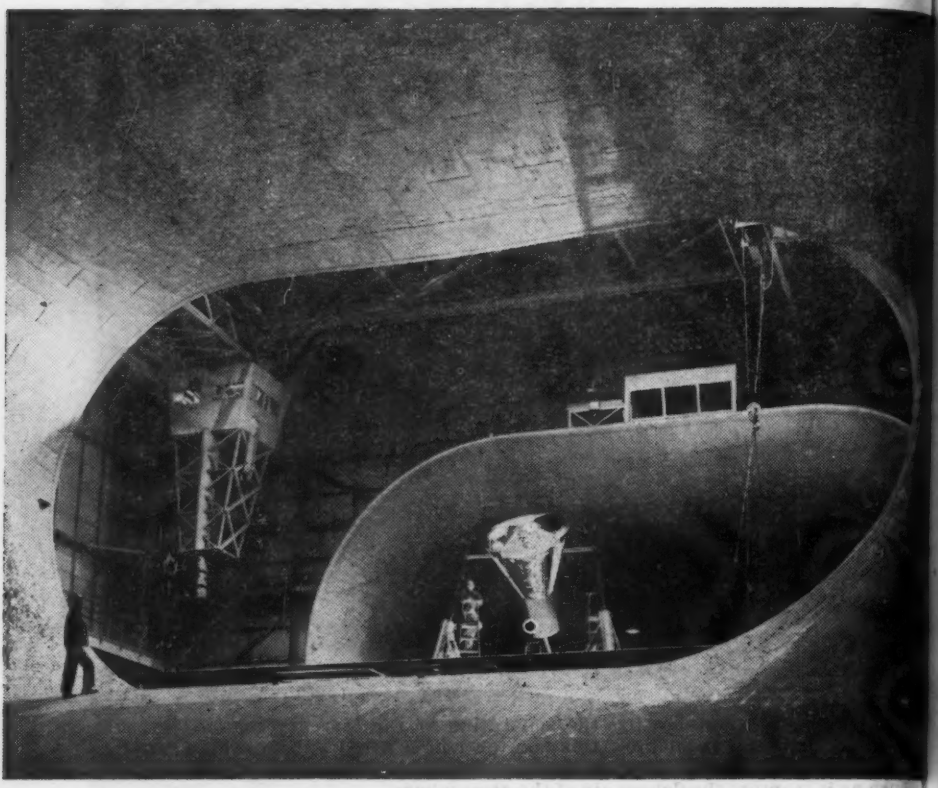
A technician performs center of gravity tests on this one-fourth scale model capsule which will be used to determine static stability in the development testing program for Project Mercury. This model, made of fiberglass reinforced plastic, weighs 33 pounds.



Artist's conception shows tests being conducted on the escape system for Project Mercury capsule. In case of an abort during staging, the rocket on top of the capsule will be fired, taking the capsule and its occupant to a safe altitude where recovery parachutes will be deployed.



An artist's conception showing the separation of the Mercury manned capsule in the foreground from the Atlas booster which lifted it into orbit. After a short time, the greater drag on the booster shell will cause it to fall back and burn as it reenters the denser air of the atmosphere.



A model of a manned satellite capsule is positioned in the full-scale tunnel of the Lan search Center, National Aeronautics and Space Administration, for tests to deter lift, drag, and static stability characteristics. These tests are included in an extens tunnel, laboratory and free-flight testing program designed to result in the optimu of the orbital vehicle. Part of the Project Mercury effort, the development tes utilize NASA facilities at Langley and Wallops Island, Va., Ames Research Cente fornia, and the Air Force's Arnold Engineering Development Center, Tullahoma,